SHEILA policy framework

SHEILA policy framework: informing institutional strategies and policy processes of learning analytics

Fname Lname
Institution
Address
Country
Email

Fname Lname
Institution
Address
Country
Email

Fname Lname
Institution
Address
Country
Email

Fname Lname
Institution
Address
Country
Email

ABSTRACT

This paper introduces a learning analytics policy development framework developed by a cross-European research project team – SHEILA (Supporting Higher Education to Integrate Learning Analytics), based on interviews with 78 senior managers from 51 European higher education institutions across 16 countries. The framework was developed using the RAPID Outcome Mapping Approach (ROMA), which is designed to develop effective strategies and evidence-based policy in complex environments. This paper presents three case studies to illustrate the development process of the SHEILA policy framework, which can be used to inform strategic planning and policy processes in real world environments, particularly for large-scale implementation in higher education contexts.

CCS CONCEPTS

• **Security and privacy~Social aspects of security and privacy** • *Applied computing~Education*

KEYWORDS

Learning analytics, policy, higher education, strategy, challenge, ROMA model

ACM Reference format:

F. Lname, F. Lname, and F. Lname. 2018. Title of your full or short paper submitted to the research track. In *Proceedings of the International Conference on Learning Analytics and Knowledge, Sydney, Australia, March 2018 (LAK'18),* 10 pages. DOI: [TO BE PROVIDED]

LAK'18, March 2018, Sydney, Australia

DOI: 10.1145/123_4

1 INTRODUCTION AND BACKGROUND

Higher Education Institutions (HEIs) are constantly collecting large amounts of data in the form of students' digital footprints during their studies. Although HEIs strive to increase the quality of teaching and learning by exploiting the collected data, there are often barriers that prevent data from being used systematically and effectively. For example, data quality, ownership and access, organisational culture, and expertise available to implement learning analytics (LA) are prevalent issues that need to be addressed before implementation [4]. According to Ferguson and others [9], although funding opportunities for LA research and activities have increased, there is still a lack of systematic and large-scale implementations of LA in higher education. The preliminary findings of a European project – SHIELA (Supporting Higher Education to Integrate Learning Analytics) have demonstrated that numerous HEIs in Europe are either observing the development of LA or have engaged with it practically without a defined strategy or monitoring framework [28]. These results illustrate the need for a sound policy framework that meets individual institution's strategic focuses and ensures a responsible and effective use of student data for LA. It is for the very reason of supporitng HEIs to become more mature users and responsible custodians of the digital data collected from students that the SHEILA project was launched.

The goal of SHEILA is to build a policy development framework to assist HEIs with the development of a context-based strategy and policy for LA. The project follows the principles of an action participatory design by involving end users of LA in the process of designing and evaluating LA products, as suggested by Knight and others [14]. It is believed that users are in the most accurate position to identify their own expectations and needs and to indicate how their practices can be supported and improved before solutions are designed. In this way, designs can ensure that solutions are consistent with user expectations and priorities [19]. As a result, SHEILA set out to understand LA users' perceptions, expectations and concerns, so as to incorporate

their views into the design process of a policy framework. The project has reached out to a diverse range of stakeholders, including institutional leaders and decision makers, teaching staff, students, and LA experts. With data collected from the direct engagement with stakeholders, the project team used the RAPID Outcome Mapping Approach (ROMA) to scope existing practices of LA among HEIs in Europe, and to make suggestions for policy development.

This paper illustrates the developing process of the first SHEILA policy framework based on interviews with senior managers in HEIs. While the SHEILA framework is based on a larger set of data collected from 51 HEIs, this paper uses three representative cases to illustrate the concept of the framework, as well as potential ways to use it for institutional strategic planning and policy formation for LA. Although the literature has suggested that ROMA model is an effective tool to support systematic adoption of learning analytics in HEIs [9, 16], there has been limited work that purposively involved different stakeholder groups to validate the feasibility of this tool for LA policy development. The contribution of our work is to bridge this gap, and extend the use of the ROMA model to address challenges recognised in the literature and raised by different stakeholder groups.

2 LITERATURE REVIEW

In spite of the potential to provide better information about student learning behaviour and progress, thereby improving the quality of educational offerings and encouraging self-regulated learning, LA has met a number of challenges that impede its adoption at an institutional level, such as the (1) demand on resources, (2) issues of ethics and privacy, and (3) stakeholder engagement and buy-in. These challenges need to be tackled through strategic planning and a sound policy framework. In this section, we outline issues identified in the literature under the three themes and introduce the ROMA (RAPID Outcome Mapping Approach) model, on which the SHEILA policy framework is based.

2.1 Learning Analytics Challenges

The first challenge – resources – covers issues around data and technological infrastructure, financial resources, and human resources. The implementation of LA typically involves complex computing and aggregating of large amounts of data, in addition to management challenges, such as the integration of research tools into existing learning environments [12]. These tasks can be difficult to perform with traditional data management technologies [13]. A survey carried out by EDUCAUSE to investigate analytics landscapes in US higher education revealed that data-quality concerns and system-integration difficulties were part of the major challenges to embedding the use of LA into institutions [3]. These findings suggest that there is a need for a financial investment in advancing institutional data infrastructure to enable LA. However, the same study by EDUCAUSE also found that LA remains an interest rather than a major priority at most institutions [3]. This finding highlights the challenge of obtaining sufficient financial support to develop a technological environment for LA or appointing analytics specialists in many HEIs if LA has to compete with other institutional priorities. For example, another EDUCAUSE report based on the same survey data pointed out that institutional analytics was twice as likely to be described as a major priority as was learning analytics, and 4 in 10 institutions reported little or no investment in learning analytics [30].

Another key dimension is human resources, which includes both the availability of staff time and expertise that is required to implement LA. In a complex educational system, the introduction of a subtle change can meet substantial resistance because of the perceived increase in workload for staff [16]. As LA makes use of data from various sources, institutions not only need data experts to obtain and analyse good quality data, but they also need the users (e.g., administrators, teaching staff, and students) to have basic data interpretation skills and the ability to reflect on data critically, in order that LA may have positive impact on informing decisions and changing behaviour [2, 18, 29]. This has been identified as a common gap between needs and solutions in institutional analytics capacity [17, 24].

The second challenge – ethics and privacy – has been identified as a major obstacle to gain buy-in from stakeholders, especially when the collection and use of data seem to risk intruding privacy [22, 26]. Like all Big Data applications, LA relies on constant and ubiquitous collection of data from students. The wide range and types of data collected could induce discomfort among data subjects due to a sense of surveillance, leading to resistance to LA [18]. Moreover, while anonymity policies are commonly enforced in HEIs when personal data is used, it can be difficult to deliver customised interventions without retaining a certain degree of individual linkages [23]. Similarly, Greller and Drachsler acknowledged the dilemma between keeping data anonymous and exploiting the most value of data [11]. To address the fear induced by ethics and privacy issues, Greller and Drachsler developed an eight-point checklist named DELICATE to facilitate a trusted implementation of LA [7].

Another key issue associated with ethics and privacy is informed consent [25]. Rubel and Jones question the extent to which students can make informed consent [23]. They point out that educational institutions may be transparent in their data practices, but the complexity of algorithms still makes analytics a 'black box' for many. Moreover, the inherent information asymmetries between data collectors and data subjects mean students tend to have limited knowledge about who can access their data, what they do with the data, and what consequences intrusions of privacy may be [7]. Similarly, Prinsloo and Slade are concerned about the best time to seek consent from students. They suggest that consent seeking should focus on downstream users rather than on the time of the initial collection of data, because the benefits of opting-in or out may not be apparent at the moment when a LA service is introduced [21].

The third challenge – stakeholder engagement and buy-in – has been highlighted in a systematic literature review where Tsai and Gašević pointed out that HEIs struggle to find common grounds among different stakeholders regarding the adoption of LA, due to discrepancies in existing experience and knowledge

of data, therefore resulting in different understanding of possible benefits and outcomes of LA [27]. Moreover, according to Tsai and Gašević, only a handful of studies have tried to explore student perspectives regarding the use of their data for learning analytics or the impact on their learning journeys, despite the fact that LA champions for a learning environment that is learner-centred and learner-concerned [10]. As mentioned earlier, concerns about ethics and privacy issues could lead to distrust in LA among stakeholders. Prinsloo and Slade, for example, specifically called for researchers to explore potential conflicts between students' concerns with their right to opt-out and the implications of personal-level interventions from HEIs [20].

A direct impact of unequal engagement with teaching professionals is the weak pedagogical grounding of LA technologies and implementation design. For example, Ali and others pointed out that LA tools still needed to move from spotting students at risk to providing pedagogically informed suggestions [1], and Macfadyen and Dawson suggested that institutions should balance solving technical challenges and developing pedagogical plans [15]. Similarly, Ferguson and colleagues highlighted that much work on LA has concentrated on the supply side, and considerably less on the demand side, for example connecting LA with education in ways that can truly support the everyday learning, teaching and assessment work [8]. Failing to consider the pedagogical context in which data is generated and interpreted can impede scalable actions of LA [24].

The phenomenon of unequal engagement with stakeholders is also reflected by the absence of clear leadership to define directions for LA adoption among many HEIs [12], which is considered a key factor associated with the maturity of LA practices at an institutional level [5, 17, 24]. In particular, the involvement of institutional leaders is crucial to the development of strategies and policies for LA, which could help mitigate the challenges identified so far. As new practices in a complex educational system potentially disrupt traditional management and organisational structures, and therefore likely to meet resistance [16], it has been suggested that institutions should start LA implementation by defining a strategic plan [2, 6, 9]. Moreover, studies have identified that existing policies related to technical standards for interoperability do not fully apply to LA practices [8], and tailored LA policies for individual institutions will be needed in order to properly consider individual institutional contexts in every phase of adoption [27]. Without dedicated input from high-level decision makers [6], it can be difficult to press for the development of LA specific strategies and policies that meet the needs of individual institutions and the members therein.

In response to the need for a strategic framework and policy to adopt LA systematically, the SHEILA project used the RAPID Outcome Mapping Approach (ROMA) to produce a policy development framework. The ROMA model was adopted as a foundation for the development of the SHEILA policy framework due to the original purpose of ROMA to support evidence-based policy development and change through active engagement with relevant stakeholders. The model has already been suggested for systemic adoption of LA in HEIs [9, 16]. The following subsection introduces the concept of the ROMA model.

2.2. The ROMA Model in Learning Analytics Contexts

The ROMA model was designed by the ODI (Overseas Development Institute) to inform policy processes in the field of international development using research evidence [31]. The model begins by defining an overarching policy objective, which is followed by six steps designed to provide policy makers with context-based information: 1) map political context, 2) identify key stakeholders, 3) identify desired behaviour changes, 4) develop engagement strategy, 5) analyse internal capacity to effect change, and 6) establish monitoring and learning frameworks. Unlike traditional linear tools and approaches, ROMA is designed to be used iteratively to inform strategic choices and meet unexpected changes (or challenges) in a complex setting. This model has been adapted to guide the planning and implementation of LA at an institutional level [9, 16] (Figure 1).

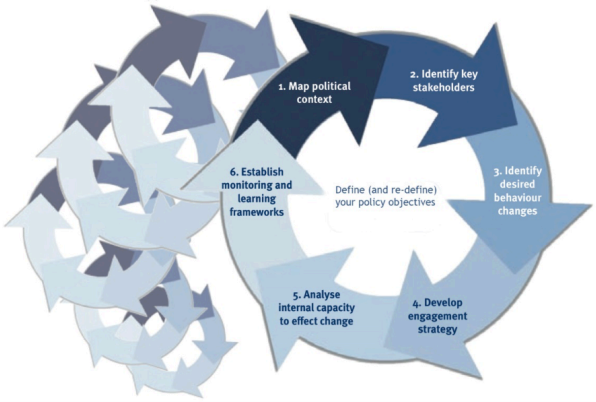

Figure 1: The RAPID Outcome Mapping Approach [9]

Ferguson and colleagues provided two case studies of LA practice from the UK and Australia to demonstrate how theoretical frameworks could be operated in the real world and, in particular, how ROMA could be used for the planning and implementation of LA in higher education contexts to maximise the success and impact of LA. Our work builds on the approach adopted by Ferguson and others [9] to map out the state of LA adoption among HEIs in Europe, and further provides suggestions to guide policy development. The following section accounts for the methods adopted to develop the SHEILA policy framework, followed by three case studies that demonstrate the use of ROMA in different institutional contexts to support policy processes for LA.

3 METHODOLOGY

The SHEILA policy framework is based on evidence from a wide range of data including an institutional survey administered to universities in Europe to understand the state of adoption of LA

(n=46), a Group Concept Mapping activity that sought opinions from LA experts on essential features of a LA policy (n=30), 64 institutional interviews with mostly senior managers (e.g., provosts, rector, deans, principals, vice principals, and vice/ pro-vice chancellor) from 51 higher education institutions across 16 countries in Europe, and local consultations with teaching staff and students at four European higher education institutions using a survey method and a focus group method.

The SHEILA policy framework was developed in phases based on the findings from the abovementioned data. The first SHEILA policy framework was developed based on the results of an analysis of 64 institutional interviews that took place between August 2016 and February 2017. Each of these interviews lasted for 30 to 60 minutes. The number of participants in each interview ranged from 1 to 3, and some participants from the same institution attended the interviews separately. This resulted in a total number of 78 participants from 51 institutions. Ten interview questions were developed to investigate 1) institutional plans for LA, 2) motivations for LA, 3) adopted strategy, 4) strategy development processes, 5) readiness preparations, 6) success and evaluation, 7) success enablers, 8) challenges, 9) ethical and privacy considerations, and 10) the interviewee's views of essential elements in a LA policy.

We used the ROMA model as a tool to analyse each institutional case by mapping out their LA related activities and challenges to the six key components of ROMA. We then synthesised the mapping results of the 51 cases and created a comprehensive table of all actions and challenges identified in the interviews. This process resulted in a list of 42 action points and 59 challenges across the six ROMA components. Based on this result and the interviewees' responses to Question 10, we generated 47 policy questions to address the key actions and challenges. Thus, the SHEILA policy framework consists of a comprehensive list of adoption actions, relevant challenges and policy prompts, framed in the six ROMA components. Figure 2 explains the concept and structure of the SHEILA policy framework.

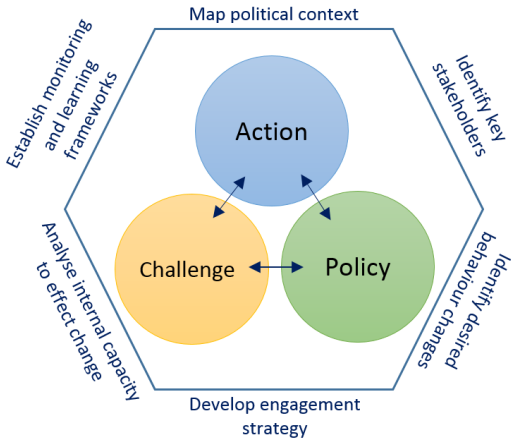

Figure 2: The SHEILA policy framework structure

We grouped the action points, challenges, and policy questions by common themes including capabilities, culture, ethics & privacy, evaluation, financial & human resources, infrastructure, internal & external support, management, methodology, purpose, and stakeholder engagement. These themes helped us to identify the main focus of action in each ROMA component and prevalent issues to address.

The following sections discuss the mapping results of three cases that are different from each other by institutional size, location, goals, and approaches to LA. While the data presented below only makes up part of our policy framework, our intention is to use them to illustrate the development process of the SHEILA policy framework, and to demonstrate how the SHEILA policy framework could be used to guide the development of institutional policies and strategic planning for LA.

4 RESULTS

In this section, we present the action points undertaken by the three selected institutions and the challenges that they faced, followed by a list of questions to reflect on when developing a LA policy in similar contexts. Each of the statements is associated with a theme. Section 4.1 presents the profiles of the three cases, including their approaches to LA. Section 4.2 presents the mapping results of the three cases using the ROMA model.

4.1 Three cases

Institution A is based in the UK and has more than 30,000 students enrolled. At the time of the interview, institution A had one central university sponsored LA project and a number of small projects initiated by individual teaching staff. In terms of the institutional uptake, institution A took an experimental approach to LA. That is, LA was adopted not as a tool to solve identified problems, but as a tool to explore new possibilities and innovations to enhance existing practice. Institution A's goal was to use LA to enhance curriculum design and student experience.

Institution B is based in Estonia and has more than 10,000 students enrolled. This institution had a few course-level LA projects previously, and was preparing an institutional LA project at the time of the interview. Institution B took a problem-based approach to LA, which is perceived as a potential solution to deal with student dropouts. The goal was to understand students' learning progress and provide interventions when needed.

Institution C is based in Spain and has more than 30,000 students enrolled. At the time of the interview, institution C did not have any institutional LA project, although there were small-scale projects carried out by individual researchers. The main goal of these projects was to explore data collected from current and past courses to identify opportunities for teaching innovations.

4.2 Six ROMA components

An analysis of the three cases using the ROMA model shows that the most common themes of challenges identified in Component 2 (stakeholders) are ethics and privacy related issues,

while those in Component 3 (desired changes), 4 (engagement strategy), and 6 (monitoring framework) are methodology related. Component 5 (capacity for changes) examined the internal capacity of the institutions, resulting in a longer list of challenges being identified compared to the other components. The common challenges in this component are related to culture, capability, and infrastructure. In contrast, the mapping of Component 1 (political context) did not identified shared themes among the comparatively shorter list of challenges. The following subsections are organised according to the six ROMA components.
Each section begins with a critical reflection on the state of adoption of LA among the three cases, followed by three tables providing further information on corresponding actions, challenges, and policy prompts respectively. These tables also present a selective part of the SHEILA policy framework, as illustrated is Figure 2.

4.2.1 Component 1 – Map political context

The mapping of Component 1 revealed institutional drivers and needs for LA. Both Case A and B faced external pressure to perform quality evaluation, which usually forms part of the key performance indicators (KPI) in HEIs. Therefore, it is particularly important for these institutions to reflect on the reasons for adopting LA – whether it is for the benefits of the institution or for learners and teachers. While LA activities in Case C were still at a grass-root level, the same policy questions would be useful to reflect on when planning a strategic movement towards institution-level adoption. That is, align individual-level research activities with the wider university strategy so as to gain support from senior managers/ decision makers.

Table 1: Map political contexts - actions

Case	Action	Theme
A	The internal driver was to use data to inform teaching and learning related decisions, and an external driver was to provide data for audits (e.g. National Student Survey).	Purpose
	Given the size of the university, it was decided that a pilot study was needed to find the best way to extract and integrate data.	Methodology
B	The internal driver was to increase teaching quality and learning motivations. The external driver was to provide data for state-level quality evaluations, which had previously highlighted the problem of student dropouts.	Purpose
C	A key driver was to gain better understanding of course related activities so as to improve the curriculum design.	Purpose

Table 2: Map political contexts - challenges

Case	Challenges	Theme
A	No challenges were identified.	N/A
B	There is no central guidance from the government regarding the use of student data in university feedback systems.	Management
C	Decentralised leadership made it difficult to take a centralised approach to LA.	Methodology

Table 3: Map political contexts - policy prompts

Policy – questions to reflect on	Theme
What are the reasons for introducing LA to students and staff? How do institutional objectives align with personal benefits for teaching staff and students?	Purpose

4.2.2 Component 2 – Identify key stakeholders

The mapping of Component 2 showed that the adoption of LA in the three cases involved a wide range of stakeholders, both internally and externally. A key implication for policy is to consider the responsibilities and rights of everyone involved, in addition to the impact on them. Case B, in particular, faced an ethical dilemma about how to make opt-out options available while addressing institutional challenges that involve every member of the institution. While there is no easy solution for this challenge, defining the circumstances of enforcing opt-out/ -in options, anonymity, and limited access to data in a policy can effectively minimise conflicts. In contrast, Case C was concerned about data re-identification, which would need to be addressed by evaluation action in Component 6 (see Section 4.2.6). An implication of this challenge for policy is to define rules about sharing data with researchers and external parties.

Table 4: Identify key stakeholders - actions

Case	Action	Theme
A	The primary internal stakeholders included students, teaching staff, senior managers and a working group made of representatives from various units. The external stakeholder was a LA service provider that offered a warehouse and analytics expertise.	Stakeholder engagegagement
B	The primary internal stakeholders included students, teaching staff, IT officers, senior managers, and the department of academic studies. The need to involve external stakeholders, such as LA experts and data scientists, was identified.	Stakeholder engagegagement
C	The main stakeholders were researchers and IT officers. However, there was indirect engagement with external researchers through the engagement of LA literature and conferences.	Stakeholder engagegage-

		ment

Table 5: Identify key stakeholders - challenges

Case	Challenges	Theme
A	It was difficult to define ownership and responsibilities among professional groups within the university.	Management
B	The provision of opt-out options conflicts with the goal to tackle institutional challenges that involve all institutional members.	Ethics & Privacy
C	Anonymised data could potentially be re-identified when matched with other pieces of data.	Ethics & Privacy

Table 6: Identify key stakeholders - policy prompts

Policy – questions to reflect on	Theme
Who is the policy for? How will responsibilities be defined for each stakeholder?	Stakeholder engagegagement
Whose data will be collected?	Methodology
How will consent be obtained? Is there an option to opt-out of (or opt into) any data collection and analysis? Who can access the data? How will anonymity policies be applied to the processing and presentation of data? Will data be shared with researchers? Will data be shared with external parties? Is it justifiable?	Data management

4.2.3 Component 3 – Identify desired behaviour changes

The mapping of Component 3 showed that the expected changes for Case B were particularly 'institution-focused', while those identified in Case C were teacher-focused. Although Case A expected to see behaviour changes among all three levels of stakeholders, there was a concern that expectations may not be met. A similar concern about returns on investment was observed in Case B where LA was also driven centrally by the institution. Therefore, it is important that the policy not only guides decision makers to focus on changes that meaningfully reflect the goals set out for LA, but also a range of indicators that can truly reflect these changes in a specific institution's context, The latter could be defined as success indicators, as suggested later in Component 6 (see Section 4.2.6).

Table 7: Identify desired behaviour changes - actions

Case	Action	Theme
A	Academic staff will better understand students' learning problems and offer support accordingly. Students will be able to reflect on how they learn, and make learning plans accordingly. The institution will be able to make better decisions to support learning and teaching based on an overview of learning and teaching effectiveness.	Purpose
B	Student dropout rates will decrease. Students will be provided with regular reports about their learning progress. The institution will make better decisions to enhance teaching quality and keep students motivated.	Purpose
C	Academic staff will better understand student learning behavior, thereby improving the way they teach. The institution will improve the quality of their educational services.	Purpose

Table 8: Identify desired behaviour changes - challenges

Case	Challenges	Theme
A	An experimental approach is susceptible to a sense of uncertainty about the return on investment.	Methodology
B	It is unclear if a problem-based approach guarantees a solution.	Methodology
C	No challenges were identified.	

Table 9: Identify desired behaviour changes - policy prompts

Policy – questions to reflect on	Theme
What changes will LA bring to the current situation? Why are these changes important to us?	Purpose
Who will benefit from learning analytics? How will the purpose of learning analytics be communicated to primary users?	Stakeholder engagement

4.2.4 Component 4 – Develop engagement strategy

The mapping of Component 4 showed that engagement data was considered primary data for LA in the three cases. The implication for policy is to define the range of data being collected and encourage 'meaningful selection' of data, so that LA will not be driven by data, but by learning or teaching goals. It is also crucial to include students and teachers in the interpretation of data so as to contextualise data and increase the validity of analytics. A common strategy shared by all three cases is to set up a working group to drive LA. It is important that the policy states the

responsibilities of the working group, particularly their role in ensuring that LA will be used responsibly within the institution. For example, the working group at Case B will need to make sure that relevant data protection regulations have been consulted, as it is not evident in the reported actions.

Table 10: Develop engagement strategy - actions

Case	Action	Theme
A	The initial engagement with LA was guided by Jisc's Code of Practice for Learning Analytics. There were preparations to develop an institutional policy to provide a framework for the use of LA in the local context.	Ethics & privacy
	Two LA specialists and a working group were set up to facilitate a pilot project with a LA service provider, engage with research activities, and develop institutional strategies.	Human resources
	The initial preparations included a review of existing LA cases. The sources of data used in the pilot project included interactions in virtual learning environments, Student Record Systems, and course marks. Sixty-five online MSc courses were involved.	Methodology
B	A diverse working group was set up to drive LA activities.	Human resources
	The working group will initiate communications among different stakeholders.	Stakeholder engagement
	The initial preparations included a review of existing LA cases and visits to other European universities to learn from best practices. The data sources included engagement data in LMS (Learning Management System) and data held in SIS (Student Information System).	Methodology
C	There were consultations on the Spanish LOPD (Organic Law on Protection of Personal Data).	Ethics & Privacy
	There was a plan to set up a working group to promote LA among teaching staff and develop ethical guidelines.	Human resources
	Social interaction data was extracted from discussion forums in the LMS.	Methodology

Table 11: Develop engagement strategy - challenges

Case	Challenges	Theme
A	Over rely on data and fail to consider the experience and knowledge of instructor/ tutors about students.	Methodology
B	While there was funding support from the government to develop student feedback systems among Estonian universities, there was no state-level coordination to initiate collaboration among universities that have received the grant.	Management
C	Focus on identifying students at risk and overlook the pedagogical design of curriculum or learning support	Methodology

Table 12: Develop engagement strategy - policy prompts

Policy – questions to reflect on	Theme
What are the objectives for LA?	Purpose
What kinds of data will be collected to achieve these objectives? What is the scope of data collection? How will the results of analytics be interpreted within the context? Will teaching staff or students be involved in the process? Who will oversee ethical conducts related to learning analytics?	Methodology

4.2.5 Component 5 – Analyse internal capacity to effect change

The mapping of Component 5 showed that the evaluation of internal capacity focused on financial, infrastructure, and human capacity. A common challenge shared by the three cases was in gaining wide support from the teaching staff among whom analytical literacy and time availability were main issues to deal with. The implication for policy is to ensure the availability of communication channels and support resources among different stakeholders. While all cases identified the challenge of accessing certain 'useful' data, Cases A and B recognised that ethical conduct needs an enabling infrastructure. Thus, it is crucial that the policy provides guidelines to keep the infrastructure updated with regard to current data protection requirements.

Table 13: Analyse internal capacity to effect change - actions

Case	Action	Theme
A	A risk evaluation was performed to analyse internal capacity.	Methodology
B	There was government funding for the development of feedback systems to support students.	Financial resources
C	There was an evaluation of the availability and usefulness of data from the LMS. Interest was expressed in cross-institution collaboration on LA research projects to enhance the integration of LA.	Infrastructure

Table 14: Analyse internal capacity to effect change - challenges

Case	Challenges	Theme
A	2018 GDPR (European General Data Protection Regulation) will bring changes to the way the university dealt with student data.	Methodology
	The existing data infrastructure could not deal with individual opt-outs. There was no single permission to use student data across the institution. Some useful data remains inaccessible, e.g. the usage record of the digital library was kept by publishers.	Infrastructure
	If Institution A failed to manage one student's request to be excluded properly, the unhappiness of one student might spread to others and start an institution-wide objection. The buy-in from teaching staff was polarised.	Culture
B	The culture of using data to inform decision-making was immature. Although compulsory training was planned for teaching and support staff, it was not clear how to foster ownership of LA among staff. The benefit of using LA to support decision-making was clear to senior managers but not to teaching staff.	Culture
	The existing infrastructure is not mature enough to process data from the LMS or to cope with privacy requirements, such as allowing individual opt-outs. Data that is potentially useful for achieving the goals of LA may not be accessible due to privacy issues.	Infrastructure
	There was a skills gap in analytics and LA project design, which posed questions regarding the validity of the current approach to LA.	Capabilities
C	The skills required to understand and interpret visualised data needed to be installed among teaching staff.	Capabilities
	Worries about the time demands in incorporating LA into teaching outweighed the perceived benefits of LA, and reduced the motivation to attend relevant training.	Culture
	Certain data outside the LMS is hard to acquire, such as social interactions in a physical classroom.	Infrastructure

Table 15: Analyse internal capacity to effect change - policy prompts

Policy – questions to reflect on	Theme
How will data integrity be achieved?	Methodology
How will the data be stored and disposed? How often will the efficiency and security of existing data infrastructure be evaluated?	Data management
Are there related policies in the institutional/ national/ international level that the LA policy sits alongside/ above/ below?	Policy management
What communication channels or feedback mechanisms will be in place? What training will be deployed? Will it be compulsory?	Stakeholder engagement

4.2.6 Component 6 – Establish monitoring and learning frameworks

The mapping of Component 6 showed that none of the three institutions had developed success criteria or defined monitoring procedures, perhaps due to the early stages of adoption. However, the challenges that confronted them indicate the urgency and importance to define success measures for LA in their contexts, particularly with the grounding of learning and teaching theories. More importantly, the policy needs to raise awareness about inadvertent consequences that may result from analytics, and suggest procedure to monitor and deal with these risks.

Table 16: Establish monitoring and learning frameworks - challenges

Case	Challenges	Theme
A	There was a fear of failing to meet expectations, resulting in a bad name for LA.	Methodology
B	It remains questionable whether student dropout rate is the best success indicator for the institutional LA project.	Methodology
C	The captured data of time spent online may not truly reflect learning. The design and implementation of LA may fail to consider pedagogical theories.	Methodology

Table 17: Establish monitoring and learning frameworks - policy prompts

Policy – questions to reflect on	Theme
How will success be measured? What are success indicators? What are the mechanisms that deal with inadvertent consequences? Who will carry out the evaluation of impact?	Evaluation
How often will the policy be reviewed and updated? Who will be responsible for the policy?	Policy management

5 DISCUSSION

The associated themes that have emerged in the mapping results show a different focus for each ROMA component. Component 1 (mapping political context) focuses on identifying the 'purpose'

for adopting LA in a specific context so as to drive actions in the other components. Component 2 (identify key stakeholders) is driven by the recognition that the implementation of LA in a social environment involves collective efforts from different stakeholders. Component 3 (identify desired behaviour changes) sets objectives, which reflect back to the 'purpose' of adopting LA. Component 4 (develop engagement strategy) defines approaches to achieving the objectives by addressing aspects that could otherwise become challenges, as identified in the literature: resources, ethics & privacy, and stakeholder engagement and buy-in (see Section 2.1). Component 5 (analyse internal capacity to effect change) focuses on assessing the availability of existing resources (e.g., data and funding) and identifying challenges (risks). Component 6 (establish monitoring and learning frameworks) is currently absent in all three cases.

This mapping process illustrates how the ROMA model can be used to examine existing LA practices and refine strategies. For example, the mapping results show that all three cases still need to consider what it means to be successful with LA and what success looks like (Component 6), so as to better inform actions related to other components. The actions taken by the three cases also provide a snapshot of the action elements in the SHEILA policy framework, which could be used to initiate strategic planning for early adopters.

In terms of challenges that confronted the three cases, the mapping of Component 5 identified key themes around culture, capability, and infrastructure. This result coincides with two of the three key LA challenges identified in the literature – demand on resources and stakeholders engagement and buy-in as introduced in Section 2.1. As a result, the policy questions focus on management issues around data integrity and security, and channels for stakeholder training and communication within the institution. The other key challenge – ethics and privacy – was particularly highlighted in the mapping of Component 2. This reaffirms the importance and urgency of addressing ethics and privacy issues that could otherwise impede buy-in from stakeholders. To this end, the policy questions particularly focus on management issues around privacy, such as consent-seeking, data access, anonymity principles, and data sharing.

While a policy does not necessarily provide direct solutions to the identified challenges, the questions in the SHEILA policy framework intend to prompt answers that could serve as suitable code of practice to mitigate the challenges. For example, answers to the policy question – "how will anonymity policies be applied to the processing and presentation of data" (see Table 6) may not provide solutions to the data re-identification challenge identified by Case C (see Table 5), as it may not be foreseen before different data sets are integrated. However, a policy could suggest that a review and test process for such risks be carried out by data specialists before data is made available to a wider population of stakeholders. This may further inform actions of Component 4 and 5, as the availability of data could be determined by the associated risks of privacy and consequently affect engagement strategy.

As identified in the literature, stakeholder engagement and buy-in has a direct impact on the scalability and sustainability of LA, which need to be supported by strategic planning, led by institutional leaders, and informed by pedagogical knowledge possessed by teaching professionals. This challenge is reflected in the mapping results of challenges associated with Component 1, 3 and 4, where 'methodology' and 'management' are key issues. As a result, the policy questions focus on defining the purpose of implementing LA and considering the value of LA to all relevant stakeholders and the specific context of the institution. Based on the identified purpose, the methodology adopted to achieve the chosen goal should also be stated in a policy, as suggested in Component 4.

6 CONCLUSION

We have presented three institutions' approaches to LA and challenges that confronted them in this paper. Using the ROMA model, we analysed actions carried out by these institutions. We extended and adapted the use of ROMA further by including challenges under the six components. Thereafter, we developed a set of questions to be addressed when formulating policy. This mapping process demonstrated the evidence-based approach that we adopted to develop the SHEILA policy framework, which contributes three types of information valuable for a systematic adoption of LA – actions, challenges, and policy. The framework could be used to guide the development of institutional policies and strategic planning for learning analytics.

We identified a strong connection between the six ROMA components. That is, the same challenge may be identified in multiple components, and an action may be informed by consideration of multiple components. While the ROMA model should be applied iteratively, there is no definite order between the components. This is why we chose to treat them as key 'components' rather than 'steps' as initially suggested by Young and Mendizabal [31], so as to acknowledge the fluidity between the six components.

This paper has presented a selective part of the SHEILA framework through three chosen cases. The framework was developed based on a series of interviews with predominantly senior managers in HEIs. Therefore, it particularly reflects the perspectives of this group of stakeholders. Our future work aims to incorporate findings from other on-going research activities, which explore views from other key stakeholders such as teachers and students, regarding the adoption of LA.

ACKNOWLEDGMENTS

This work was supported by the Erasmus+ Programme of the European Union [562080-EPP-1-2015-1-BE-EPPKA3-PI-FORWARD]. The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflects the views only of the authors, and the Commission will not be held responsible for any use which may be made of the information contained therein. The project involved collaborative input from all the partners involved and

their contributions are highly appreciated. We would also like to give thanks to our research participants for their valuable contributions.

REFERENCES

[1] Ali, L., Asadi, M., Gašević, D., Jovanović, J. and Hatala, M. 2013. Factors influencing beliefs for adoption of a learning analytics tool: An empirical study. *Computers & Education*. 62, (Mar. 2013), 130–148. DOI:https://doi.org/10.1016/j.compedu.2012.10.023.

[2] Arnold, K.E., Lynch, G., Huston, D., Wong, L., Jorn, L. and Olsen, C.W. 2014. Building Institutional Capacities and Competencies for Systemic Learning Analytics Initiatives. *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge* (New York, NY, USA, 2014), 257–260.

[3] Arroway, P., Morgan, G., O'Keefe, M. and Yanosky, R. 2016. *Learning Analytics in Higher Education*. ECAR.

[4] Bichsel, J. 2012. *Analytics in Higher Education: Benefits, Barriers, Progress, and Recommendations*. ECAR.

[5] Colvin, C., Dawson, S., Wade, A. and Gaśević, D. 2017. Addressing the Challenges of Institutional Adoption. *Handbook of Learning Analytics*. C. Lang, G. Siemens, A. Wise, and D. Gaśević, eds. Society for Learning Analytics Research. 281–289.

[6] Colvin, C., Rogers, T., Wade, A., Dawson, S., Gasevic, D., Shum, S.B., Nelson, K., Alexander, S., Lockyer, L., Kennedy, G., Corrin, L. and Fisher, J. 2015. *Student Retention and Learning Analytics: A Snapshot of Australian Practices and a Framework for Advancement*. The Australian Government Office for Learning and Teaching.

[7] Drachsler, H. and Greller, W. 2016. Privacy and Analytics: It's a DELICATE Issue a Checklist for Trusted Learning Analytics. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (New York, NY, USA, 2016), 89–98.

[8] Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., Rienties, B., Ullmann, T. and Vuorikari, R. 2016. *Research Evidence on the Use of Learning Analytics: Implications for Education Policy*.

[9] Ferguson, R., Macfadyen, L.P., Clow, D., Tynan, B., Alexander, S. and Dawson, S. 2014. Setting Learning Analytics in Context: Overcoming the Barriers to Large-Scale Adoption. *Journal of Learning Analytics*. 1, 3 (Sep. 2014), 120–144.

[10] Gašević, D., Dawson, S. and Siemens, G. 2015. Let's not forget: Learning analytics are about learning. *TechTrends*. 59, 1 (Jan. 2015), 64–71. DOI:https://doi.org/10.1007/s11528-014-0822-x.

[11] Greller, W. and Drachsler, H. 2012. Translating Learning into Numbers: A Generic Framework for Learning Analytics. *Educational Technology & Society*. 15, 3 (2012), 42–57.

[12] Higher Education Commission 2016. *From Bricks to Clicks - The Potential of Data and Analytics in Higher Education | Higher Education Commission*.

[13] Jeremic, Z., Kumar, V. and Graf, S. 2017. MORPH: Supporting the integration of learning analytics at institutional level. *Proceedings of the Seventh International Learning Analytics & Knowledge Conference* (New York, NY, USA, 2017), 596–597.

[14] Knight, D.B., Brozina, C., Stauffer, E.M., Frisina, C. and Abel, T.D. 2015. Developing a Learning Analytics Dashboard for Undergraduate Engineering Using Participatory Design. (Jun. 2015), 26.485.1-26.485.11.

[15] Macfadyen, L. and Dawson, S. 2012. Numbers are not enough. Why e-learning analytics failed to inform an institutional strategic plan. *Faculty of Education - Papers (Archive)*. (Jan. 2012), 149–163.

[16] Macfadyen, L.P., Dawson, S., Pardo, A. and Gaševic, D. 2014. Embracing Big Data in Complex Educational Systems: The Learning Analytics Imperative and the Policy Challenge. *Research & Practice in Assessment*. 9, (2014), 17–28.

[17] Norris, D.M. and Baer, L.L. 2013. *Building Organizational Capacity for Analytics*.

[18] Pardo, A. and Siemens, G. 2014. Ethical and privacy principles for learning analytics. *British Journal of Educational Technology*. 45, 3 (May 2014), 438–450. DOI:https://doi.org/10.1111/bjet.12152.

[19] Park, Y. and Jo, I.-H. 2015. Development of the learning analytics dashboard to support students' learning performance. *Journal of Universal Computer Science*. 21, 1 (2015), 110–133.

[20] Prinsloo, P. and Slade, S. 2017. Ethics and Learning Analytics: Charting the (Un)Charted. *Handbook of Learning Analytics*. C. Lang, G. Siemens, A. Wise, and D. Gaśević, eds. Society for Learning Analytics Research. 49–57.

[21] Prinsloo, P. and Slade, S. 2015. Student Privacy Self-management: Implications for Learning Analytics. *Proceedings of the Fifth International Conference on Learning Analytics And Knowledge* (New York, NY, USA, 2015), 83–92.

[22] Roberts, L.D., Howell, J.A., Seaman, K. and Gibson, D.C. 2016. Student attitudes toward learning analytics in higher education: "The fitbit version of the learning world." *Frontiers in Psychology*. 7, (Dec. 2016), 1–11. DOI:https://doi.org/10.3389/fpsyg.2016.01959.

[23] Rubel, A. and Jones, K.M.L. 2016. Student privacy in learning analytics: An information ethics perspective. *The Information Society*. 32, 2 (Mar. 2016), 143–159. DOI:https://doi.org/10.1080/01972243.2016.1130502.

[24] Siemens, G., Dawson, S. and Lynch, G. 2013. *Improving the Quality and Productivity of the Higher Education Sector: Policy and Strategy for Systems-level Deployment of Learning Analytics*. Society for Learning Analytics Research for the Australian Office for Learning and Teaching.

[25] Slade, S. and Prinsloo, P. 2013. Learning Analytics: Ethical Issues and Dilemmas. *American Behavioral Scientist*. 57, 10 (Mar. 2013), 1510–1529. DOI:https://doi.org/10.1177/0002764213479366.

[26] Slade, S. and Prinsloo, P. 2014. Student perspectives on the use of their data: Between intrusion, surveillance and care. *Challenges for Research into Open & Distance Learning: Doing Things Better – Doing Better Things* (Oxford, UK, Oct. 2014), 291–300.

[27] Tsai, Y.-S. and Gašević, D. 2017. Learning analytics in higher education — challenges and policies: A review of eight learning analytics policies. *Proceedings of the Seventh International Learning Analytics & Knowledge Conference* (New York, NY, USA, 2017), 233–242.

[28] Tsai, Y.-S. and Gaševic, D. 2017. *The State of Learning Analytics in Europe – Executive Summary – SHEILA*.

[29] Wolff, A., Moore, J., Zdrahal, Z., Hlosta, M. and Kuzilek, J. 2016. Data Literacy for Learning Analytics. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (New York, NY, USA, 2016), 500–501.

[30] Yanosky, R. and Arroway, P. 2015. *The Analytics Landscape in Higher Education*. ECAR.

[31] Young, J. and Mendizabal, E. 2009. *Helping Researchers Become Policy Entrepreneurs-How to Develop Engagement Strategies for Evidence-based Policymaking*. Overseas Development Institute.